DIAGNOSES AND DISTRIBUTION OF FIFTEEN SPECIES RECOGNIZED IN GENUS *MAUROLICUS* COCCO (STERNOPTYCHIDAE, STOMIIFORMES) WITH A KEY TO THEIR IDENTIFICATION

by

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ABSTRACT. - According to the recent revision (Parin and Kobyliansky, 1993), the genus *Maurolicus* contains fifteen allopatric species differing in combination of a few characters of which number of vertebrae, gill rakers and pectoral fin rays, head length, eye diameter, body depth and pigmentation of stomach and intestine are most important. *M. muelleri* (Gmelin) occurs only in the eastern North Atlantic. All other species also have restricted ranges in the Mediterranean Sea and adjacent Atlantic Ocean (*M. amethystinopunctatus* Cocco), western North and equatorial Atlantic (*M. weitzmani* Parin & Kobyliansky), western South Atlantic (*M. stehmanni* Parin & Kobyliansky), central South Atlantic at Discovery seamount (*M. inventionis* Parin & Kobyliansky), eastern South Atlantic and western South Indian Ocean (*M. walvisensis* Parin & Kobyliansky), western tropical Indian Ocean at Saya de Malha Bank (*M. kornilovorum* Parin & Kobyliansky), Red Sea (*M. mucronatus* Klunzinger), eastern tropical Indian Ocean and Coral Sea (*M. javanicus* Parin & Kobyliansky), western North Pacific and Sea of Japan (*M. japonicus* Ishikawa), central North Pacific at seamounts of North-western and Hawaiian ridges (*M. imperatorius* Parin & Kobyliansky), western South Pacific (*M. australis* Hector), eastern South Pacific (*M. parvipinnis* Vaillant), eastern South Pacific at seamounts of Nazca ridge (*M. rudjakovi* Parin & Kobyliansky), and eastern equatorial Pacific (*M. breviculus* Parin & Kobyliansky). Maximum body length of the species varies from 30 mm SL in *M. kornilovorum* to 65 mm SL in *M. muelleri*. All species of *Maurolicus* are benthopelagic fishes most abundant over upper continental slopes and submarine rises.

RÉSUMÉ. - Selon une révision récente (Parin et Kobyliansky, 1993), le genre *Maurolicus* comprend 15 espèces allopatriques différant par la combinaison de quelques caractères dont les plus importants sont le nombre de vertèbres, de branchiospines et de rayons à la nageoire pectorale, la longueur de la tête, le diamètre de l'oeil, la hauteur du corps, la pigmentation de l'estomac et de l'intestin. *M. muelleri* (Gmelin) vit seulement dans l'Atlantique nord-est. Toutes les autres espèces ont aussi une aire de répartition restreinte, Méditerranée et Atlantique adjacent (*M. amethystinopunctatus* Cocco), Atlantique nord et équatorial (*M. weitzmani* Parin & Kobyliansky), Atlantique sud-ouest (*M. stehmanni* Parin & Kobyliansky), Atlantique central sud au guyot Discovery (*M. inventionis* Parin & Kobyliansky), Atlantique sud-est et Océan Indien sud-ouest (*M. walvisensis* Parin & Kobyliansky), Océan Indien tropical ouest au Banc Saya de Malha (*M. kornilovorum* Parin & Kobyliansky), Mer Rouge (*M. mucronatus* Klunzinger), Océan Indien tropical est et Mer de Corail (*M. javanicus* Parin & Kobyliansky), Pacifique nord-ouest et Mer du Japon (*M. japonicus* Ishikawa), Pacifique central nord aux guyots du nord-ouest et à la ride d'Hawaï (*M. imperatorius* Parin & Kobyliansky), Pacifique sud-ouest (*M. australis* Hector), Pacifique sud-est (*M. parvipinnis* Vaillant), sud-est aux guyots de la ride de Nazca (*M. rudjakovi* Parin & Kobyliansky), et Pacifique équatorial est (*M. breviculus* Parin & Kobyliansky). La longueur standard maximale varie entre 30 mm chez *M. kornilovorum* et 65 mm chez *M. muelleri*. Toutes les espèces de *Maurolicus* sont benthopélagiques, le plus abondantes au-dessus de la partie supérieure des pentes continentales et des dorsales océaniques.

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Key-words. - Sternoptychidae, *Maurolicus*, Deep sea fishes, Taxonomy, Distribution.

Genus *Maurolicus* is conventionally considered to be monotypic (Grey, 1964; Mukhacheva, 1981) and was recently revised by the authors (Parin and Kobyliansky, 1993). We recognized fifteen species of which five were re-validated from the synonymy of *M. muelleri* and nine described as new. The cited paper by Parin and Kobyliansky was written in Russian and only 300 copies were published. This shortened version is intended to make our results more easily available to the international community of ichthyologists.

All species of *Maurolicus* are very similar externally. Unlike most other luminescent fishes they have almost the same pattern and number of photophores. Our taxonomical decisions are based, therefore, on a very limited set of characters of which the most important are the number of vertebrae (Table I), gill rakers on the first arch (Table II), pectoral fin rays and serial photophores posterior to the anal fin origin (AC-photophores). The species differ also in some body proportions - for example, *M. muelleri* is slender-bodied and short-headed whilst *M. breviculus* is deep-bodied and long-headed (Fig. 1). Details of internal pigmentation are also used as distinguishing features (Fig. 2). Combinations of these few characters allow all fifteen species to be distinguished. Their distributional ranges are shown in figure 3.

Table I. - Number of vertebrae in 15 species of *Maurolicus*. ETA: eastern equatorial Atlantic; WNA: western North Atlantic; WNP: western North Pacific.

	Number of vertebrae					
Species	**30**	**31**	**32**	**33**	**34**	**35**
M. muelleri	-	-	-	4	28	4
M. inventionis	-	-	-	5	25	6
M. stehmanni	-	-	-	11	6	-
M. parvipinnis	-	-	-	12	53	11
M. amethystinopunctatus	-	-	-	9	38	2
M. walvisensis	-	-	-	5	14	1
M. rudjakovi	-	-	4	38	2	-
M. australis	-	-	-	21	11	-
M. imperatorius	-	-	7	25	1	-
***M. weitzmani* - WNA**	-	-	2	11	-	-
***M. weitzmani* - ETA**	-	-	-	6	1	-
***M. japonicus* - WNR**	-	-	2	13	2	-
***M. japonicus* - Hawaii**	-	-	-	17	1	-
M. kornilovorum	-	3	20	9	-	-
M. mucronatus	2	3	1	-	-	-
M. javanicus	2	8	-	-	-	-
M. breviculus	-	-	15	41	-	-

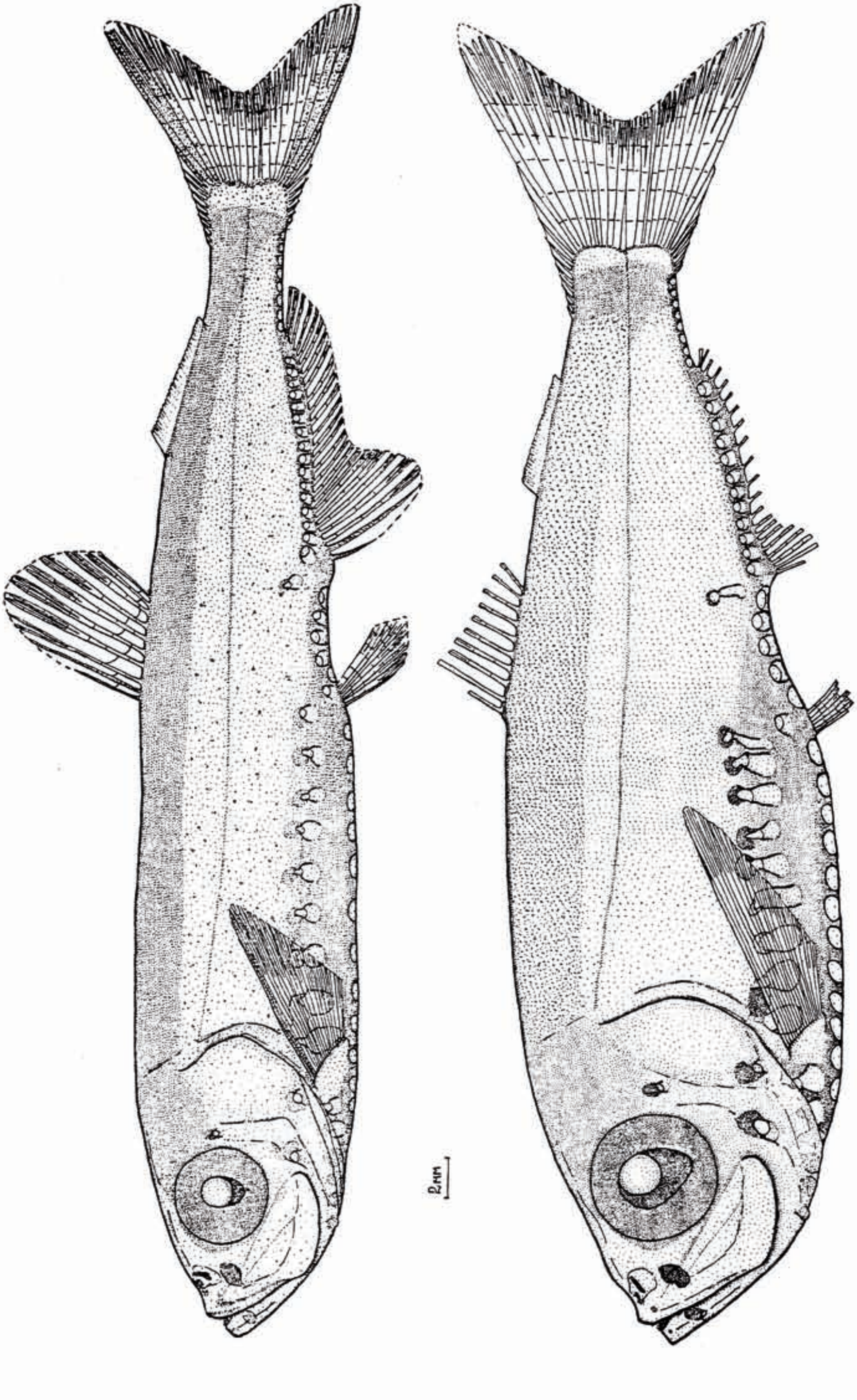

Fig. 1. - External view of a typical slender-bodied and short-headed species, *Maurolicus muelleri*, and deep-bodied and long-headed species, *M. breviculus*.

Species	Number of gill rakers														
	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
M. muelleri	-	-	-	-	-	-	-	1	8	12	3	1	-	-	-
M. muelleri (M)	-	-	-	-	-	1	2	19	53	107	56	25	-	-	-
M. inventionis	-	-	-	-	-	-	-	-	-	1	4	11	6	3	-
M. inventionis (M)	-	-	-	-	-	-	-	-	-	8	12	37	22	5	1
M. stehmanni	-	-	-	-	-	-	4	7	6	1	-	-	-	-	-
M. parvipinnis	-	-	-	-	-	1	7	10	4	1	-	-	-	-	-
M. amethystinopunctatus	-	-	-	-	1	8	9	7	-	2	-	-	-	-	-
M. amethystinopunctatus (M)	-	-	-	1	9	37	23	12	3	2	-	-	-	-	-
M. walvisensis	-	-	-	-	1	8	11	4	1	-	-	-	-	-	-
M. rudjakovi	-	-	-	-	1	1	19	3	-	-	-	-	-	-	-
M. rudjakovi (M)	-	-	-	2	5	5	3	1	-	-	-	-	-	-	-
M. australis	-	-	-	-	-	-	1	10	12	4	3	1	-	-	-
M. australis (M)	-	-	-	-	-	-	2	5	7	10	3	1	-	-	-
M. imperatorius	-	-	-	-	-	-	1	10	10	7	3	-	-	-	-
M. imperatorius (M)	-	-	-	-	-	1	2	8	7	5	5	-	-	-	-
M. weitzmani - WNA	-	-	6	14	2	1	-	-	-	-	-	-	-	-	-
M. weitzmani - ETA	3	6	5	6	2	-	-	-	-	-	-	-	-	-	-
M. japonicus - WNP	-	-	1	6	8	1	2	-	-	-	-	-	-	-	-
M. japonicus - Hawaii	-	-		4	6	6	1	-	-	-	-	-	-	-	-
M. kornilovorum	-	4	7	5	3	-	-	-	-	-	-	-	-	-	-
M. mucronatus	-	-	2	2	1	-	-	-	-	-	-	-	-	-	-
M. javanicus	-	1	6	1	1	-	-	-	-	-	-	-	-	-	-
M. breviculus	-	1	15	10	16	4	-	-	-	-	-	-	-	-	-

Table II. - Number of gill rakers in 15 species of *Maurolicus*. (M): data of Mukhacheva (1981) for "*M. muelleri*" from different geographic localities; ETA, WNA and WNP: as in table I.

Key to species

1a. Head length 25-29% SL. Eye diameter 8-10% SL **2**
1b. Head length 28.5-34% SL. Eye diameter 9.5-11.5% SL **4**
2a (1a). Maximum body depth 19-22% SL; North-eastern Atlantic .... *M. muelleri*
2b (1a). Maximum body depth 23-26% SL **3**
3a (2b). Vertebrae usually 34, rarely 33 or 35. Gill rakers 30-35; South-eastern Atlantic .... *M. inventionis*
3b (2b). Vertebrae usually 33, rarer 34. Gill rakers 27-30; South-western Atlantic .... *M. stehmanni*
4a (1b). Gill rakers 25-32 .... **5**
4b (1b). Gill rakers 21-26 .... **10**
5a (4a). Vertebrae usually 34, rarely 33 or 35 .... **6**
5b (4b). Vertebrae usually 33, rarer 32 or 34 .... **8**
6a (5a). Pectoral fin rays usually 17, rarer 16 or 18. [Hinder part of intestine weakly pigmented (brownish)]; South-eastern Pacific .... *M. parvipinnis*
6b (5a). Pectoral fin rays 18, rarer 17 or 19 .... **7**
7a (6b). Hinder part of intestine intensely pigmented (black); Mediterranean Sea and North-eastern Atlantic .... *M. amethystinopunctatus*
7b (6b). Hinder part of intestine not pigmented; South-eastern Atlantic and South-western Indian Ocean .... *M. walvisensis*
8a (5b). Gill rakers 25-28, usually 26-27; South-eastern Pacific .... *M. rudjakovi*
8b (5b). Gill rakers 27-32, usually 28-30 .... **9**
9a (8b). Pectoral fin rays 17, rarer 18. Hinder part of intestine intensely pigmented (black); South-western Pacific .... *M. australis*
9b (8b). Pectoral fin rays 18, rarer 17 or 19. Hinder part of intestine not pigmented; North-western Pacific .... *M. imperatorius*
10a (4b). Maximum body depth 21-28% SL. First PV-photophores of the right and left sides not adjoining **11**
10b (4b). Maximum body depth 27-31% SL. First PV-photophores of the right and left sides adjoining; Eastern equatorial Pacific .... *M. breviculus*
11a (10a). Vertebrae usually 32-33, rarely 31 .... **12**
11b (10a). Vertebrae usually 30-31, rarely 32 .... **14**
12a (11a). Vertebrae usually 33, rarely 32 .... **13**
12b (11a). Vertebrae usually 32, rarely 31 or 33. [Stomach with pigmented bands]; Western Indian Ocean .... *M. kornilovorum*
13a (12a). Stomach unpigmented; Western Atlantic and eastern equatorial Atlantic .... *M. weitzmani*
13b (12a). Stomach dark; Sea of Japan and north-western Pacific .... *M. japonicus*
14a (11b). AC-photophores usually 25-26, rarer 24 or 27. Head length 28-31% SL; North-eastern Indian Ocean and Coral Sea .... *M. javanicus*
14b (11b). AC-photophores usually 22-23, rarer 24 or 25. Head length 31-34% SL; Red Sea .... *M. mucronatus*

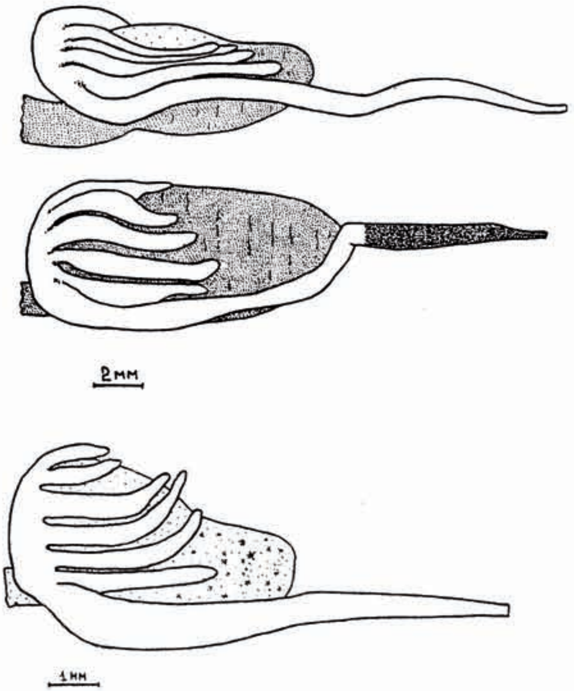

Fig. 2. - Pigmentation of stomach and intestine in *Maurolicus rudjakovi* (A), *M. australis* (B) and *M. kornilovorum* (C).

Maurolicus muelleri **(Gmelin)**

Salmo muelleri Gmelin, 1789:1378 (Soendmoer, Norway).
Argentina pennanti Walbaum, 1792:47 (Downing, England).
Scopelus borealis Nilsson, 1832:20 (western Norway).
Scopelus humboldti (nec Risso) Yarrell, 1836:34 (England).

Diagnosis. - Vertebrae 33-35, usually 34. Gill rakers 28-32, usually 29-31. AC-photophores 23-27, usually 25-26. Pectoral fin rays 17-19. Head 26-29% SL, eye 8-10% SL, upper jaw 13-16% SL, maximum body depth at pectoral fin base 19-22% SL. Stomach and hind portion of intestine pigmented. Attains 65 mm SL.

Distribution. - Eastern North Atlantic from 40-45°N to Spitsbergen and Novaya Zemlya; most western record at 47°30'N, 43°W.

Maurolicus inventionis **Parin & Kobyliansky**

Maurolicus inventionis Parin & Kobyliansky, 1993:83 (holotype ZIL 50101, 54 mm SL, 42°18'S, 0°08'E).

Diagnosis. - Vertebrae 33-35, usually 34. Gill rakers 30-35, usually 31-33. AC-photophores 23-27, usually 24-26. Pectoral fin rays 17-19. Head 25-28% SL, eye 8-10% SL, upper jaw 14-16% SL, maximum body depth well behind pectoral fin base 23-26% SL. Stomach weakly pigmented, hind portion of intestine not pigmented. Attains 63 mm SL.

Distribution. - Eastern South Atlantic at Discovery Seamount (42°S, 0°E).

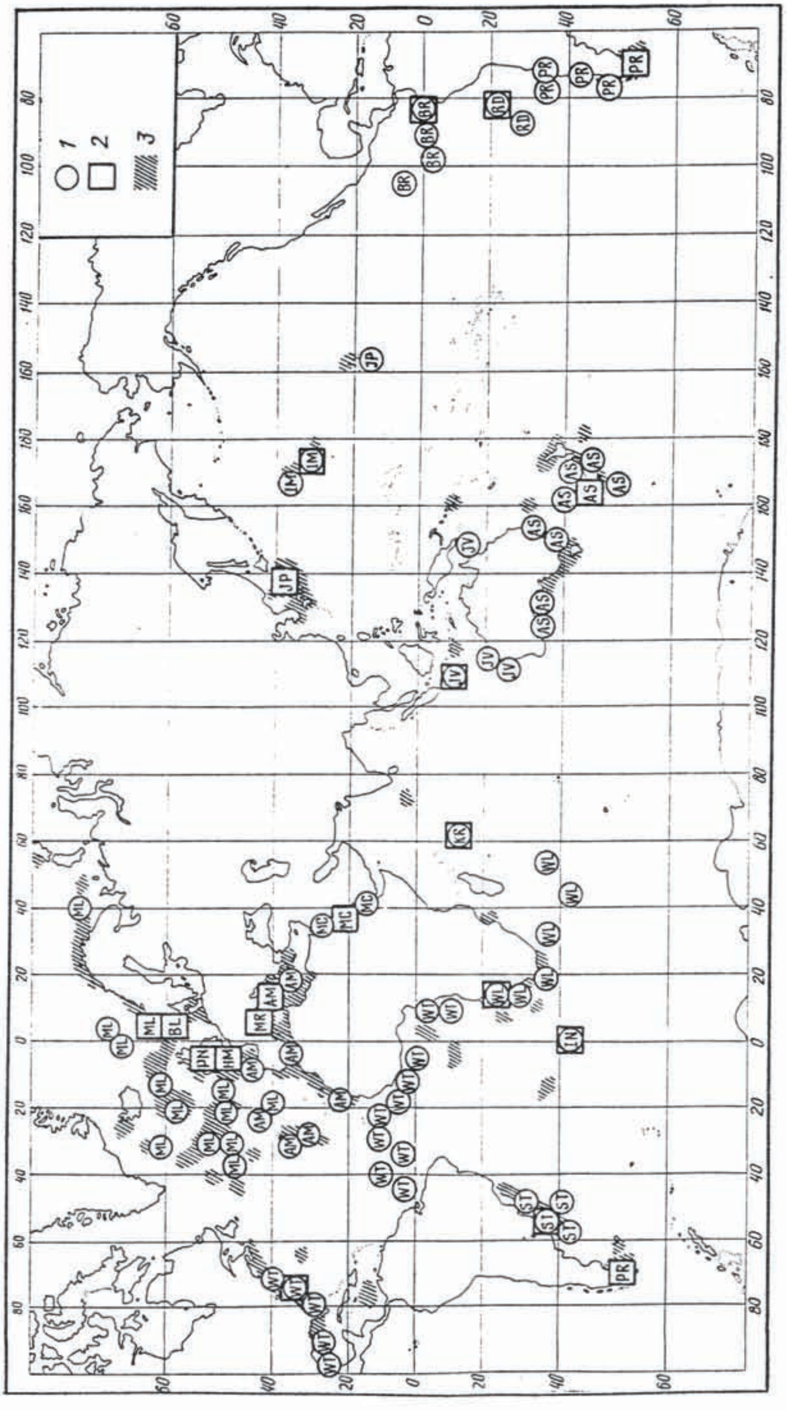

Fig. 3. - Geographical distribution of *Maurolicus*. **1**: specimens examined (a single symbol may indicate more than one capture); **2**: type locality; **3**: data from literature and museum catalogues. Valid species: AM: *M. amethystinopunctatus*; AS: *M. australis*; BR: *M. breviculus*; IM: *M. imperatorius*; KR: *M. kornilovorum*; MC: *M. mucronatus*; ML: *M. muelleri*; PR: *M. parvipinnis*; RD: *M. rudjakovi*; ST: *M. stehmanni*; WL: *M. walvisensis*; WT: *M. weitzmanni*. Junior synonyms of *M. muelleri*: BL: *Scopelus borealis*; HM: *S. humboldti*; PN: *Argentina pinnanti*. Junior synonym of *M. amethystinopunctatus*: MR: *Scopelus maurolici*.

Maurolicus stehmanni Parin & Kobyliansky

Maurolicus stehmanni Parin & Kobyliansky, 1993:85 (holotype ISH 1006-1966, 45.0 mm SL, 37°23'S, 54°52'W).

Diagnosis. - Vertebrae 33-34, usually 33. Gill rakers 27-29, usually 28-29. AC-photophores 24-26, usually 25-26. Pectoral fin rays 17-19. Head 27-29% SL, eye 8.5-10% SL, upper jaw 15.5-17% SL, maximum body depth well behind pectoral fin base 23-25% SL. Stomach and hind portion of intestine not pigmented. Attains 46 mm SL.

Distribution. - Western South Atlantic along continental slope of South America between 34-40°S.

Maurolicus parvipinnis Vaillant

Maurolicus parvipinnis Vaillant, 1888:17 (Orange Bay, southern Chile).

Diagnosis. - Vertebrae 33-35, usually 34. Gill rakers 26-29, usually 27-28. AC-photophores 23-27, usually 24-25. Pectoral fin rays 16-18. Head 28.5-32% SL, eye 9.5-12.5% SL, upper jaw 16-18% SL, maximum body depth at pectoral fin base 22-25% SL. Stomach and hind part of intestine weakly pigmented. Attains 54 mm SL.

Distribution. - Eastern South Pacific off southern Chile and Juan Fernandez Is.

Maurolicus amethystinopunctatus Cocco

Maurolicus amethystinopunctatus Cocco, 1838:193 (Mediterranean Sea).
Scopelus maurolici Valenciennes *in* Cuvier et Valenciennes, 1849:439 (Mediterranean Sea).

Diagnosis. - Vertebrae 33-35, usually 34. Gill rakers 25-30, usually 26-28. AC-photophores 23-27, usually 25. Pectoral fin rays 17-19. Head 29-32% SL, eye 10-11.5% SL, upper jaw 16-19% SL, maximum body depth at pectoral fin base 23-26.5% SL. Stomach and hind portion of intestine intensely pigmented. Attains 48 mm SL.

Distribution. - Mediterranean Sea and adjacent part of eastern North Atlantic along the slopes of southern Europe and north-western Africa (Portugal to Senegal), also off Azores and adjoining seamounts.

Maurolicus walvisensis Parin & Kobyliansky

Maurolicus walvisensis Parin & Kobyliansky, 1993:90 (holotype ZIL 50111, 41.0 mm SL, 25°05'S, 13°59'E).

Diagnosis. - Vertebrae 33-35, usually 34. Gill rakers 25-29, usually 26-27. AC-photophores 22-27, usually 24-26. Pectoral fin rays 17-19. Head 29-31% SL, eye 10-11.5% SL, upper jaw 16-19% SL, maximum body depth well behind pectoral fin base 23-25% SL. Stomach pigmented, hind portion of intestine not pigmented. Attains 47 mm SL.

Distribution. - Eastern South Atlantic along the continental slope of southwestern Africa, also at seamounts in western South Indian Ocean; most eastern record at 35°30'S, 53°E.

Maurolicus rudjakovi Parin & Kobyliansky

Maurolicus rudjakovi Parin & Kobyliansky, 1993:91 (holotype ZIL 50113, 59.2 mm SL, 22°07'S, 81°18'W).

Diagnosis. - Vertebrae 32-34, usually 33. Gill rakers 25-28, usually 27. AC-photophores 23-26, usually 23-25. Pectoral fin rays 17-19. Head 28.5-31% SL, eye 10-11.5% SL, upper jaw 16-18.5% SL, maximum body depth behind pectoral fin base 22-25% SL. Stomach lightly pigmented, hind part of intestine not pigmented. Attains 59 mm SL.

Distribution. - Eastern South Pacific at seamounts of Nazca Ridge.

Maurolicus australis **Hector**

Maurolicus australis Hector, 1875:250 (Milford Sound, New Zealand).

Diagnosis. - Vertebrae 33-34, usually 33. Gill rakers 27-32, usually 28-29. AC-photophores 22-25, usually 23-24. Pectoral fin rays 17-18. Head 29-31% SL, eye 10-11.5% SL, upper jaw 16-18% SL, maximum body depth at pectoral fin base 22-25% SL. Stomach and hind portion of intestine intensively pigmented. Attains 50 mm SL.

Distribution. - Western South Pacific off New Zealand and southern Australia.

Maurolicus imperatorius **Parin & Kobyliansky**

Maurolicus imperatorius Parin & Kobyliansky, 1993:94 (holotype ZIL 50115, 49.0 mm SL, 32°17'N, 173°11'E).

Diagnosis. - Vertebrae 32-34, usually 33. Gill rakers 27-31, usually 28-30. AC-photophores 23-26, usually 24. Pectoral fin rays 17-19. Head 29-33% SL, eye 9.5-11% SL, upper jaw 15.5-19% SL, maximum body depth at pectoral fin base 21-24% SL. Stomach lightly pigmented, hind portion of intestine not pigmented. Attains 51 mm SL.

Distribution. - Central North Pacific at seamounts of North- western and Hawaiian Ridges.

Maurolicus weitzmani **Parin & Kobyliansky**

Maurolicus weitzmani Parin & Kobyliansky, 1993:95 (holotype MCZ 64761, 39.5 mm SL, 34°23'N, 75°37'W).

Diagnosis. - Vertebrae 32-33, usually 33. Gill rakers 21-26, usually 22-24. AC-photophores 22-26, usually 23-24. Pectoral fin rays 17-18. Head 29.5-33% SL, eye 9.5-11.5% SL, upper jaw 17-19% SL, maximum body depth at or behind pectoral fin base 22.5-25.5% SL. Stomach and hind portion of intestine not pigmented. Attains 52 mm SL.

Distribution. - Western North Atlantic from Fundy Bay, Canada to Gulf of Mexico and eastern tropical Atlantic along the slope of Africa between 11°N and 6°S, also at seamounts of Vavilov Ridge; as well midwater records known in Equatorial Atlantic westward to 45°W.

Maurolicus japonicus **Ishikawa**

Maurolicus japonicus Ishikawa, 1915:183 (Toyama Bay, Sea of Japan).

Diagnosis. - Vertebrae 32-34, usually 33. Gill rakers 23-27, usually 24-25. AC-photophores 22-26, usually 24-25. Pectoral fin rays 17-19. Head 27.5-31% SL, eye 10-11.5% SL, upper jaw 16.5-18% SL, maximum body depth at or behind pectoral fin base 23-26% SL. Stomach intensively pigmented, hind part of intestine not pigmented. Attains 48 mm SL.

Distribution. - Southern Sea of Japan, western North Pacific off Japan north to 40°N; isolated population off Hawaii.

Maurolicus kornilovorum Parin & Kobyliansky

Maurolicus kornilovorum Parin & Kobyliansky, 1993:99 (holotype ZIL 50120, 28.9 mm SL, 11°40'S, 61°10'E).

Diagnosis. - Vertebrae 31-33, usually 32. Gill rakers 22-25, usually 23-24. AC photophores 22-25, usually 23-24. Pectoral fin rays 18. Head 31-33% SL, eye 10.5-11.5% SL, upper jaw 16-18% SL, maximum body depth at or behind pectoral fin base 24-26.5% SL. Stomach striped by pigment, hind portion of intestine not pigmented. Attains 32 mm SL.

Distribution. - Western tropical Indian Ocean at Saya de Malha Bank.

Maurolicus javanicus Parin & Kobyliansky

Maurolicus javanicus Parin & Kobyliansky, 1993:100 (holotype AMS I.24316-006, 43.6 mm SL, area between 0°04' and 10°04'S, 97°55' and 122°43'E).

Diagnosis. - Vertebrae 30-31, usually 31. Gill rakers 22-24. AC photophores 24-27, usually 25-26. Pectoral fin rays 16-17. Head 28.5-31% SL, eye 9.5-10.5% SL, upper jaw 16.5-17.5% SL, maximum body depth at or behind pectoral fin base 23-25% SL. Stomach and hind part of intestine not pigmented. Attains 44 mm SL.

Distribution. - Eastern tropical Indian Ocean off Java and Australia, northern Coral Sea.

Maurolicus mucronatus Klunzinger

Maurolicus mucronatus Klunzinger, 1871:593 (Red Sea).

Diagnosis. - Vertebrae 30-32, usually 31. Gill rakers 23-25. AC photophores 22-26, usually 23-24. Pectoral fin rays 17-18. Head 31-34% SL, eye 10.5-12% SL, upper jaw 17-19% SL, maximum body depth at pectoral fin base 24-26. Stomach and hind portion of intestine not pigmented. Attains 34 mm SL.

Distribution. - Red Sea.

Maurolicus breviculus Parin & Kobyliansky

Maurolicus breviculus Parin & Kobyliansky, 1993:102 (holotype ZIL 50124, 26.5 mm SL, 0°54'N, 84°01'W).

Diagnosis. - Vertebrae 32-33, usually 33. Gill rakers 22-26, usually 23-25. AC-photophores 20-24, usually 22-23. Pectoral fin rays 15-17. First PV photophores of the right and left sides adjoining (separate in all other species). Head 30-34% SL, eye 11-13% SL, upper jaw 18-20% SL, maximum body depth well behind pectoral fin base 27-31% SL. Stomach intensely pigmented, hind portion of intestine not pigmented. Attains 34 mm SL.

Distribution. - Eastern equatorial Pacific off Ecuador and Galapagos Is.

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